Ontario Resources

FOREST RESEARCH NOTE

1987 No. 43

Small-Scale Seed Extractory

by

D.E. Irving, K.J. Gashoka and D.A. Skeates[1]

Introduction

The seed research program of the Ontario Tree Improvement and Forest Biomass Institute covers many projects which require the extraction of seed from individual tree collections of black and white spruce (Picea mariana (Mill.) B.S.P., Picea glauca (Moench) Voss). These include collections for provenance and progeny studies, for monitoring of seed yield and quality from a range of seed production areas and seed orchards, and for evaluation of treatments designed to increase seed yield and quality. Collections are made from areas across Ontario and extracted and evaluated at the seed laboratory at Maple.

To facilitate extraction of seed from such collections, a small-scale seed extractory was designed and built at OTIFBI. It could be used for any small scale extraction, but its use here is to ensure thorough extraction for seed studies. The equipment used for storing and drying cones and for extracting, dewinging, conditioning and cleaning of seed is illustrated and described in this note.

Cone Storage

A moveable dexion rack was built on Sheppard casters (Fig. 1). Large cone lots are placed in large screen-bottom trays with a maximum capacity of 50 litres. Up to 12 screen-bottom boxes of various sizes, depending on cone lot size, fit into each large tray for storage of small cone lots (Fig. 2).

Figure 1 Storage rack with large .5 HL trays

[1] Ontario Tree Improvement and Forest Biomass Institute, Ministry of Natural Resources, Maple, Ontario

Further information may be obtained from:

Ontario Tree Improvement and Forest Biomass Institute
Ministry of Natural Resources
Maple, Ontario L0J 1E0

88-04323/

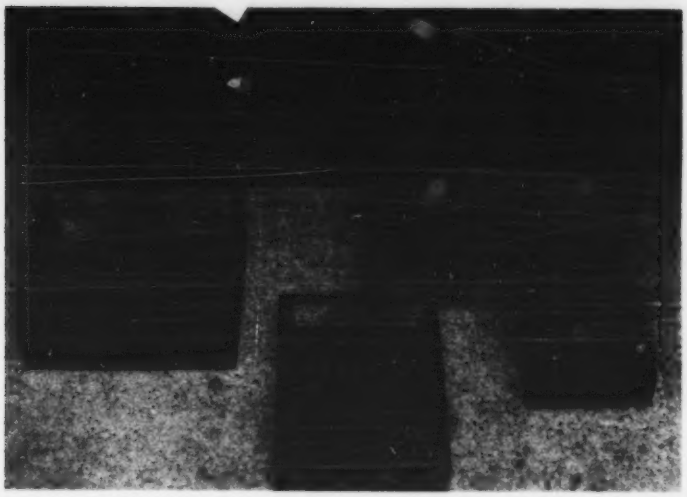
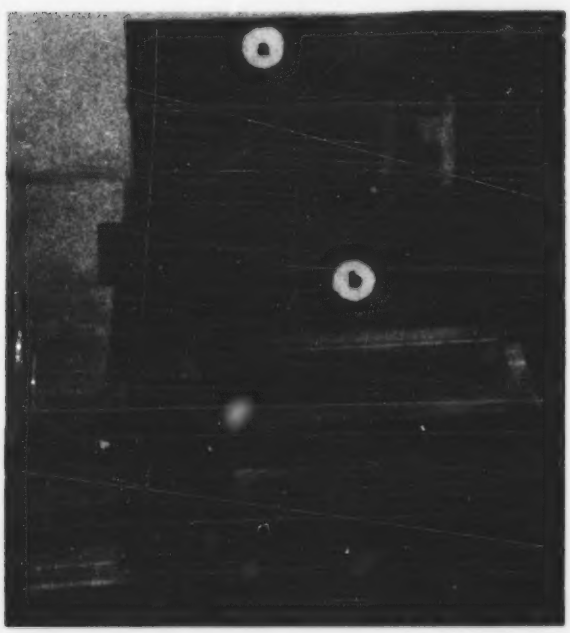


Figure 2 Small cone drying boxes of varying size

Figure 3 Cone drying kiln

Kilns

The screen-bottom boxes with individual small cone lots are placed into 230 volt convection ovens (Fig. 3). The oven used at OTIFBI is a commercial 1600 watt kiln produced by Cenco Instruments Corp. Temperatures are fixed by species, but duration of heating and the number of times a cone lot is recycled through this process may vary from one cone lot to the next, depending on size of cones and degree of opening. Cones are soaked between cycles to reduce the tension in scales, resulting in fuller cone opening in subsequent kiln cycles.



Extraction

A tumbler with a capacity of up to four litres (Fig. 4) was designed to facilitate handling of single cone lots. A 30 cm diameter drum was covered with 6.3 mm hardware cloth. This is rotated using a time-controlled variable-speed motor to achieve different tumbling rates and times. Schedules vary according to size of cone lot and species, or based on observation of seed release.

Figure 4 Cone tumbler to extract seed

The unit is enclosed in a frame covered with corrugated plastic. Cones are loaded from a hopper above the tumbler (a), through an overlapped gap in the screening of the drum (b). Seeds fall through the screen and are collected in a tray below (c). After the seed is removed, the rotation of the drum is reversed and the cones fall through the gap to be collected in the tray. A trap door fitted to the gap prevents cones from falling out during extraction when large quantities of cones are to be tumbled.

For specific studies of total seed yields from black spruce cones, where seed damage is unimportant, a blender was modified to break cones apart. A circular perforated plate was substituted for the blades on the blender. Seed from individual cones is extracted by vigorous tumbling. The winged seeds and small debris fall through or around the plate. Without tearing the cone apart, complete extraction of black spruce seed is impossible.

Dewinging

A small-scale dewinger (Fig. 5), designed at the Ontario Tree Seed Plant at Angus, Ontario, on the principle of a small cement mixer, was modified at OTIFBI. Multiple units are possible so that two or more seed lots can be processed at a time. Each unit consists of a one-litre bucket (a) bolted to a wooden disc (b) which is rotated by a variable-speed electric motor. A series of pulleys, connected by belts from the motor to the tumbler, reduces the rate of rotation. Belts also connect the various tumbling units. A second bucket (c) of the same size nests into the first on each unit.

Extracted seed, wings and other debris from the tumbling process are screened to remove large debris such as cone scales. From this, the seed lot is put into a bucket which slips easily into the bucket bolted to the machine. A scraper (d) is spring mounted on a stand in front of each bucket to improve the tumbling action. Buckets are mounted at a 20° angle to the horizontal to contain the tumbling seed as the buckets rotate.

To operate, a mist spray is used to dampen the seeds and wings, causing the latter to stick together and to the container as the seed is pulled free. If necessary, the scraper is put in place to keep the seed tumbling rather than sticking to the bucket. For very small seed lots without enough material to interact and separate, extra wings are added from past extractions. These are conditioned at high temperature prior to use, as a precaution against the unlikely possibility of any stray seed remaining with the wings to contaminate the seed lot.

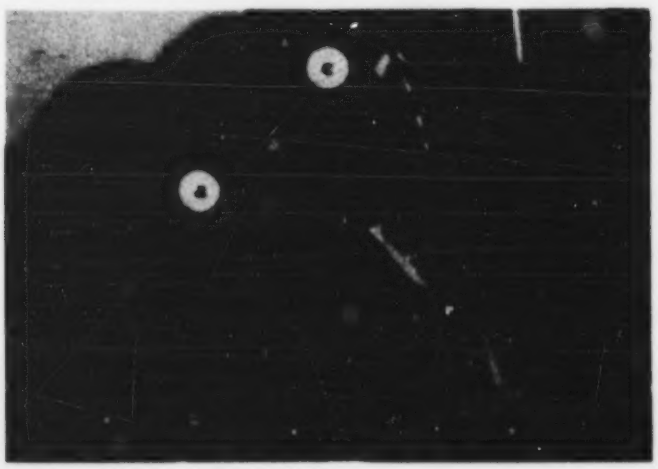


Figure 5 A 2-unit tumbler for separating seeds from wings

Conditioning

Following dewinging, the seed lots are placed in screen-bottom boxes and put in a conditioning cabinet to reduce seed moisture content (Fig. 6). Heat is provided by two heat lamps. Two small fans ensure circulation of air within the cabinet and an exchange of air from without. A calibrated opening in the cabinet regulates the rate of exchange of heated, high humidity air which results from drying the seed.

Figure 6 Conditioning cabinet.

Cleaning

Once the seed lot has been dried, low-density waste materials are separated from filled seed in an aspirator (Fig. 7). This eliminates wings, empty seed and low-density debris. The air column may also be used to effect a separation of the filled seed on the basis of seed density, by control of air flow.

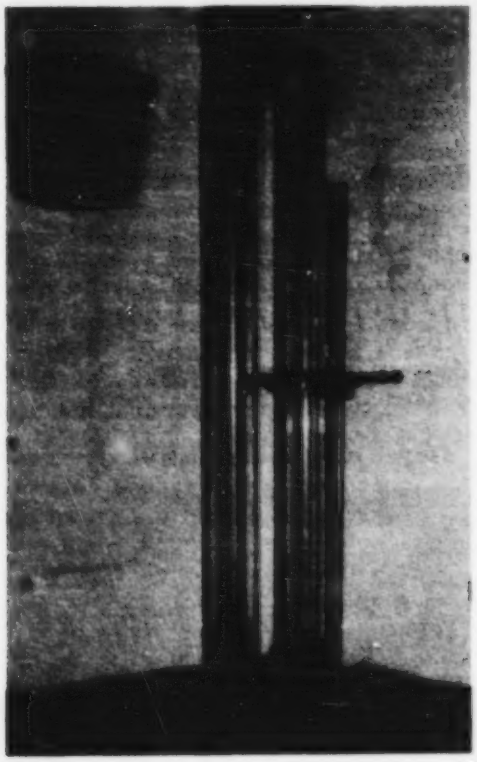


Figure 7 Aspirator for cleaning or grading of seed by density

The basic elements of the aspirator are a 1/4 HP motor controlling a blower unit, and two glass tubes. The base of the first tube is a bakelite sleeve connecting the tube to the blower. A bakelite cup of the same dimension as the inside of the sleeve and with a fine mesh screen bottom holds the seed lot in the air flow. The cup fits snugly into an opening cut in the sleeve. Low-density material is blown to the top of the column. A fine mesh screen at the top of the system reduces air pressure, allowing the lower density material to drop out of suspension down a second tube into a cup below. The high-density material drops back into the cup at the base of the first tube as the air flow is cut off.

Sketches and material requirements for building the various pieces of equipment are available on request.

Acknowledgements

Photography by Jean Robinson, OTIFBI. The original design of the aspirator was by V.H.H. Williamson of OTIFBI, subsequently modified by authors.